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THE FAILURE AND REVIVAL OF THE PROCESS OF PIGMENTATION IN THE HUMAN SKIN

By A. E. Jenks

DEPARTMENT OF SOCIOLOGY AND ANTHROPOLOGY, UNIVERSITY OF MINNESOTA

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In the year 1914 I published an illustrated study entitled 'A Piebald Family of White Americans.'¹

Further research shows that my conclusion then [one of 'the apparent positive results of this [that] research'], namely, that the spotting of the skin was due to 'progressive albinism,' was correct. To get the matter fairly before us I quote herewith my former conclusions, together with explanations which accompanied them. Attention is especially directed to number 4 below:

Without going further into details at this time, I may summarize the apparent positive results of this research so far in hand, as follows:

That in the family before us we see—

1. Hereditary spotting of the skin.
2. The character of spotting behaves as a simple Mendelian dominant.
3. The piebald persons are heterozygous for this character of spotting.
4. The condition of spotting is albinistic, and is progressive rather than fixed, giving progressive albinism—sometimes called dynamic leucosis.

It may be well to present here definitions of albinism in its three commonly recognized phases:

Complete albinism affords no visible pigment anywhere in *skin*, *hair* or *eyes*.

Incomplete albinism affords visible pigment of various degrees of diffusion everywhere in *skin*, *hair*, and *eyes*.

Partial or imperfect albinism affords visible pigmentation limited to areas separated by unpigmented areas. This gives 'piebald' and 'spotted' cases.

Concerning the probable close interrelation between these various phases of unpigmented skin, Pearson says:

When we consider the relative rareness of complete albinism, of the spotted or splashed condition and of xanthism, their relatively frequent coincidence in² the same stock suggests that these abnormal pigment conditions are not wholly independent, and that as a working hypothesis it is reasonable to suppose that complete albinism, partial albinism, incomplete albinism, and xanthism, all static forms of leucosis, are phases of the same process and are probably linked with leucoderma and possibly other forms of dynamic leucosis. By 'linked' we suggest that they mark the complete, incomplete, local, or progressive failure of the same metabolic process, which may never start at all, never start in certain areas, or be imperfectly started, and again being started may fail to maintain itself; further, that every variety of this failure may individually or collectively be associated with certain stocks, which may either show hereditary failure of one phase, of several, or exceptionally of all phases of pigment metabolism."¹

Pigmentation is due to *pigment metabolism*. In 'complete albinism' pigment metabolism completely fails to start. In 'incomplete albinism' pigment metabolism occurs only incompletely. In 'partial or imperfect albinism' pigment metabolism locally fails or never starts. In 'progressive albinism,' or dynamic leucosis, pigment metabolism, though having apparently once started at some time, fails in certain areas.³

Before giving proofs of progressive albinism as shown by the recent research, let me add another quotation from the original study which states two of the five problems then left open for further investigation:

2. Whether the albinistic areas extend their borders after once having been known, or whether there is, instead, a progressive failure of pigment metabolism within a definite area.⁴

3. Whether an at-one-time albinistic area ever revives within itself the process of pigment metabolism.⁵

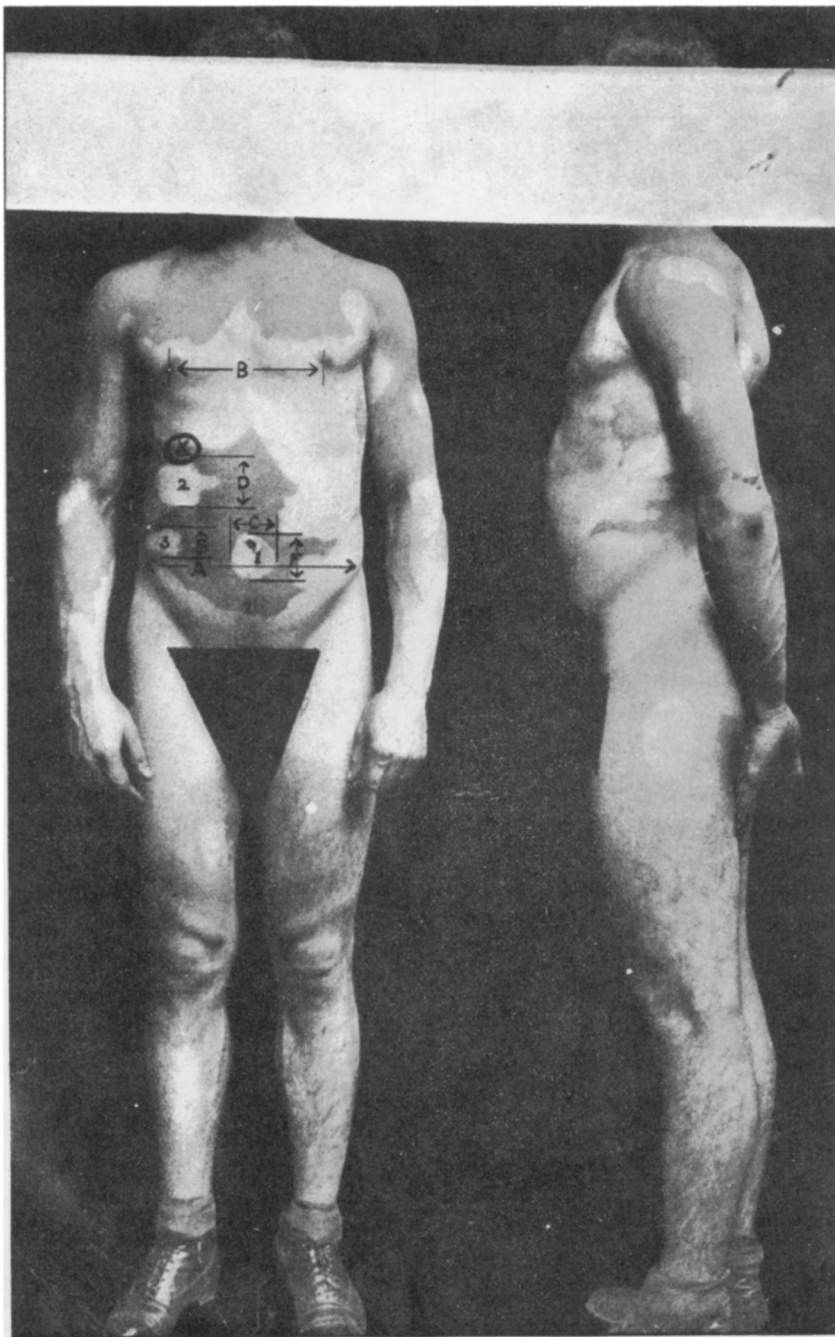
Problem number 2 has been solved. There is an extension of the albinistic areas.

Problem number 3 has also been solved, and its solution is surprising. There is a revival of the process of pigment metabolism within an at-one-time albinistic area.

The process followed in the study of the two problems (numbers 2 and 3 above) follows.

Two negatives of the same individual⁶ were made as early as possible from the same points of view. The second negative was taken following a lapse of six months after the making of the first negative. The two negatives were measured by Mr. H. B. Wilcox,⁷ Scholar in Astronomy at the University of Minnesota. The measurements were made on the Repsold photographic-plate measuring machine owned by the Department of Astronomy, University of Minnesota. Two lenses (one of 30 diameters, and one of 10 diameters) were used in the measurements of the distance "C" shown on Plate I. It is the horizontal measurement across the albinistic spot enclosing the navel. All subsequent measurements were made by use of the lower, or 10-diameter lens, because it resulted in better definition. However, the accuracy of the measurements by the 10-diameter lens is well confirmed by the one duplicate measure made by the 30-diameter lens, since the results obtained by the two lenses agree within the limits of error.

The error indicated is based on the theory of Least Squares—the theory of error universally employed in measurements of stellar photographs. However, attention should be called to the possibility of systematic error. This possibility of systematic error is, nevertheless, not



ABNORMALLY PIGMENTED WHITE AMERICAN SHOWING PROGRESSIVE ALBINISM

(Diagrams in black show areas measured. The black circle surrounding an "X," above area 2, has nothing to do with the present presentation.)

great, as is shown by the checking measurements made on both negatives between the points indicated by lines "A" and "B." The ratio of negative number 2 (the one made six months later than the other) to negative number 1, as shown by measurement "A" on both negatives is 1.338 ± 0.002 . The ratio of negative 2 to negative 1, as shown by measurement "B" on both negatives, is 1.339 ± 0.002 .

The following results were obtained by measurements of areas numbered 1, 2, and 3 on Plate I.

Results of Measurement of Albinistic Areas⁸

Area	Measurement	Per cent of increase	Per cent of decrease	Per cent of error
1	C		6.5	$\pm .9$
2	D	3.5		$\pm .5$
3	E	4.0		± 1.0
1	F	1.0		± 1.0

These results proclaim that the albinistic areas extended their borders, as shown by measurements "D" on area number 2, "E" on area number 3, and "F" on area number 1. The results also proclaim that the process of pigment metabolism was revived in area number 1, as shown by measurement "C," where the decrease of the size of the area was 6.5 per cent of its total height (vertical measurement of the body) with a possible error of $\pm 0.9\%$.

¹ *Amer. Anthropol.*, New York, N. S., 16, 222-237 (1914).

² *Ibid.*, p. 234. ³ *Ibid.*, p. 235.

⁴ *Ibid.*, p. 233. ⁵ *Ibid.*, p. 234.

⁶ Number 32 of the Genealogical Chart, Fig. 74, p. 222 of *Op. Cit.*

⁷ Mr. Wilcox is recognized as a most careful expert in the field of stellar photographic measurements.

⁸ A detailed histological study of the skin of this person may be found in the article referred to in footnote number 1.

BANDED GLACIAL SLATES OF PERMO-CARBONIFEROUS AGE, SHOWING POSSIBLE SEASONAL VARIATIONS IN DEPOSITION

By Robert W. Sayles

UNIVERSITY MUSEUM, HARVARD UNIVERSITY

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Near Boston, on the peninsula of Squantum, facing Quincy Bay, is a formation of tillite of Permo-Carboniferous age, described in 1914.¹ Lying conformably on the tillite is a slate formation with a known thickness of about 800 feet.